North Pacific Research Board

Bering Sea Integrated Ecosystem Research Program

Final Report

BSIERP Data Management

NPRB BSIERP Project B51 Final Report

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Abstract

The National Center for Atmospheric Research (NCAR) Earth Observing Laboratory (EOL) Computing Data and Software (CDS) facility provided the data management support for the North Pacific Research Board (NPRB) Bering Sea Integrated Ecosystem Research Program (BSIERP). The EOL had also been managing data for the related National Science Foundation (NSF) sponsored Bering Ecosystem Study (BEST) from its inception in 2006. At the request of NPRB, EOL began handling the data management for the BSIERP Principal Investigators (PIs) in December 2010 and continued doing so until the last dataset was received in June 2015 and the BSIERP archive was completed.

Picking up the data management responsibilities for an ongoing project presented its own challenges and opportunities. At the outset, EOL software engineers and data managers finalized an inventory of current and anticipated BSIERP datasets, working from information supplied by NPRB, and developed a procedure for integrating these datasets into the EOL Metadata, Data and Cyberinfrastructure data management system (EMDAC). This first step provided a repository for the BSIERP datasets and metadata documentation at NCAR in order to assure long term continuity of data management support.

Bringing data from the two Bering Sea programs together into a single facility expedited the workflow for dataset submission, archival and sharing among BEST, BSIERP, and the larger science community. It also illustrated the benefits that could be realized in a single data repository from the two related field programs. EOL entered discussions with the Program Managers and the BEST-BSIERP Science Advisory Board (SAB) on developing a single data access point for datasets from both programs in Fall 2010. This single data access strategy for both BSIERP and BEST data was realized five months after EOL commenced the cataloging and archiving of data and metadata for the BSIERP program.

Key words

metadata, FGDC, ISO 19115, taxonomy, metavist, model, data archive, Master List, Bering Sea, oceanography

Citation

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Study Chronology: Funded from December 13, 2010 to March 31, 2012. A no cost extension was granted to July 30, 2012. Continuing funding was arranged through a new sub-award from August 1, 2012 through September 30, 2013. A no cost extension was granted through March 31, 2014. Project was extended from April 1, 2014 through December 31, 2014, with a no cost extension through June 30, 2015.

Introduction

The National Center for Atmospheric Research (NCAR) Earth Observing Laboratory (EOL) Computing Data and Software (CDS) facility began providing data management support in 2010 for the North Pacific Research Board (NPRB) Bering Sea Integrated Ecosystem Research Program (BSIERP). EOL had been providing all facets of data management support to the related Bering Ecosystem Study (BEST) field program, sponsored by the National Science Foundation (NSF), since its inception in 2006. The BEST-BSIERP programs were a multi-year, interdisciplinary collaborative effort to develop an end-to-end mechanistic understanding of how climate change affects the marine ecosystems of the eastern Bering Sea, the continued use of their resources, and the social, economic and cultural sustainability of the people who depend on them. Managing such diverse data collected over several years of fieldwork by over one hundred scientists from federal, state, university, and private institutions presented a unique set of challenges. The Earth Observing Laboratory utilized software and procedures developed during previous Arctic field projects to manage the data from the BEST program, then enhanced the capabilities of these tools to better serve the unique character of the ecosystem study.

At the request of NPRB, the NCAR/EOL began managing the data for the BSIERP field program in December 2010. A closer integration of the datasets from the two field projects was achieved by bringing the data management for the joint BEST-BSIERP programs together within NCAR/EOL. Doing so enabled the development of a single access point for the data, in keeping with the collaborative nature of the programs. Together, these datasets of the BEST-BSIERP programs comprise the Bering Sea Project Archive. This report documents the procedures implemented to assume responsibility for data management of the BSIERP project, and the software development that went into expanding and combining the BEST and BSIERP data management efforts to create the comprehensive Bering Sea Project Archive. The critical tasks, diverse origins of the data, and the approach to long term archive and access are described in this report.

Objectives

Data management support provided by EOL for the BSIERP program included comprehensive support for investigator data submission, data access control, metadata generation, project dataset inventory and tracking, metadata catalogs, dataset archiving, and long-term stewardship. The following list in chronological order enumerates the data management support provided to the BSIERP Program by individual objectives and a description of the achievements.

1. *Develop a procedure for integrating current and future BSIERP data sets into the EOL Data Management System, retaining the full BSIERP Federal Geographic Data Committee (FGDC) compliant metadata records as Extensible Markup Language (XML) files, and transferring metadata conforming to the EOL Arctic Data Profile into the EOL database.*

EOL transferred the BSERP data and metadata to EOL servers and began actively managing the datasets and resources. The data and metadata arrived at EOL on an external hard drive, and were subsequently examined closely for integrity and completeness. Catalogs of the datasets were compared to data set lists supplied by the former BSIERP data managers at the University of Alaska and from NPRB online resources. Metadata records in the form of FGDC XML files were modified to reflect NCAR/EOL as the publisher and archive, and inoperative links in the metadata were updated to point to EOL resources. BSIERP datasets were integrated with the BEST datasets by utilizing a shared metadata profile for database entries. The EOL Arctic Data Profile is a metadata profile developed for the Arctic Observing Network (AON) and derived from the International Polar Year metadata profile. New data submissions during this period were accepted and cataloged for future archiving.

2. *Develop BSIERP data management web pages at EOL for continuity in submission and access to BSIERP datasets.*

An EOL BSIERP data web home page was developed to provide access to the datasets once they entered the NCAR/EOL data archive. The Program Managers from NPRB and NSF, and selected BSIERP PIs, provided input as "beta" testers. The preliminary web pages and data access methods were updated to address feedback on usability from the testers, and the web site was subsequently put online at http://www.eol.ucar.edu/projects/bsierp/.

3. *Provide a repository for any new or updated BSIERP data sets and documentation at EOL, as an immediate interim step to assure long continuity of data management support.*

Data submissions were accepted for BSIERP projects and entered into the EMDAC system. As they were submitted, these datasets were posted and made available through the EOL BSIERP Program data archive web site.

4. *Finalize an inventory of current and anticipated future BSIERP data sets.*

Information from other NPRB progress reports was instrumental to completing this task. Additions were made to this inventory as a collaborative effort between EOL, NPRB and the BSIERP Principal Investigator (PI) Team.

5. *Incorporate the BSIERP data set documentation, FGDC compliant metadata, and data files into the EOL data archive.*

At the beginning of the project the metadata team at the United States Geological Survey/National Biological Information Infrastructure Clearinghouse (USGS/NBII) was collaborating with EOL to ensure the BSIERP metadata records submitted with datasets were complete and accurate. They also provided assistance as needed to the investigators in recording metadata that met the guidelines of the FGDC Biological Data Profile. EOL then mapped the FGDC metadata to the EOL Arctic Data Profile and they were entered into the EMDAC system. As a result of budgetary constraints, the USGS/NBII program was terminated on January 15, 2012 and EOL no longer had recourse to USGS assistance with biological metadata. EOL acquired knowledge of taxonomic records, as a consequence, and connected with the Integrated Taxonomic Information System (ITIS). Thereafter, EOL took over full responsibility for checking the FGDC biological records and taxonomies, and assisting PIs with the creation of their metadata.

6. *Develop "master list" tables for BSIERP datasets using established procedures applied to all data.*

EOL utilizes these "master list" tables for all aspects of data discovery, display and selection. EOL consulted with the BSIERP PI Team, the SAB, and the NPRB Program Manager, regarding specific project disciplines and activities before customizing "master list" templates to meet BSIERP needs (example as shown in Figure 1).

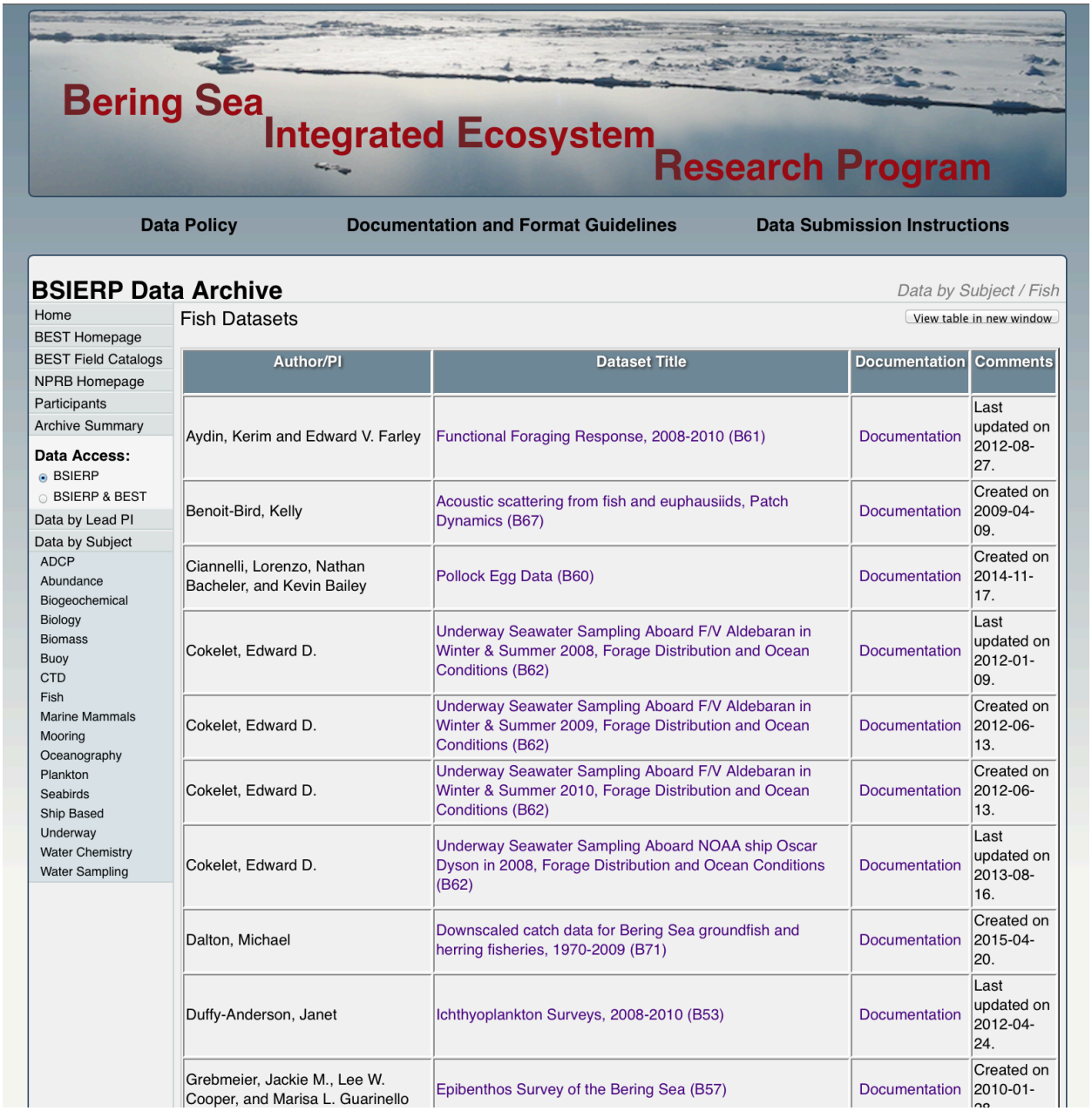


Figure 1. Screenshot of the "master list" table for datasets with subject "fish" from the first EOL BSIERP Data Archive site

7. Make the BSIERP data accessible through the EOL EMDAC system together with the BEST data.

Development began on a common entry point to both the BSIERP and BEST datasets. The separate BEST and BSIERP data archives were brought together to connect seamlessly, with data from both programs accessible from a newly created central web home page for all the data. This new site, in common for both program datasets, was recognized as the "Bering Sea Project

Archive." The EOL organized and continues to maintain the Bering Sea Project Archive as the single source for all data from the combined efforts of the BEST and BSIERP programs. (http://beringsea.eol.ucar.edu/) See Figure 2 for a screenshot of this web page.

Figure 2. Screenshot of the comprehensive Bering Sea Project Archive site

8. *Collaborate with Axiom, the data manager for AOOS, on unified approaches to access and display data in the BSIERP archive.*

The plan was to share expertise, avoid duplication, and eventually work towards BEST-BSIERP visualization through the BSIERP/Axiom Data Portal. EOL started a conversation with Axiom and made all datasets open and accessible so they could be uploaded into the Axiom system. No

real progress was made during the consolidated Bering Sea Project phase of the data management support. After the initial conversations, it appeared to us that Axiom had higher priorities in other activities and they never got back to us on any sort of collaboration. EOL did prepare for viewing on the Bering Sea Project Archive site Eastern Bering Sea Model visualizations by Alexander Kurapov and visualizations for a Climatological Oceanographic Atlas of the Bering Sea supplied by Gleb Panteleev.

9. *Review the XML metadata files to ensure they conform to the FGDC metadata standard, check for errors and flag them. Work on cleaning up and improving the metadata for each dataset to bring them into conformance with the FGDC standard.*

In order to track the progress on this task, a web page (http://beringsea.eol.ucar.edu/errors/) was created with a table of results (see Figure 3) from checking each dataset through a metadata parser, *mp*, developed by USGS. USGS describes *mp* as a "quality control and output configuration tool. It acts as a compiler to parse formal metadata, checking the syntax against the FGDC Content Standard. It can be configured for the Biological Data Profile and other extensions." (http://www.usgs.gov/core_science_systems/csas/metadata/tools.html). EOL cleaned up the FGDC XML metadata files in rounds, resolving one type of error in each round. At the start there were numerous errors in all but a few of the metadata files. By the end of the cleanup rounds, the error count was down to zero for each and every BSIERP dataset metadata file. The only files with errors remaining were the original NPRB template file and the example metadata file created from it that were distributed to BSIERP PIs at the beginning of the program. These were left "as is" for continuity purposes.

Metadata Inventory

Date Last Updated: 05/15/2015 22:03:50 — Total # Files: 85

Severity Level	Five	Four	Three	Two	One	Zero
# Files	0	0	0	2	0	85

Template Filename	Link to Template	Severity Level	Errors	
			HTML	TXT
nprb_metadata_template	document	2	html	txt
NPRB_METADATA_SAMPLE_[0313_seals_time_at_depth-AF26JUL_draft]	document	2	html	txt

Metadata Filename	Associated Dataset	Link to Metadata	Severity Level	Errors	
				HTML	TXT
B52_EcoFOCI_m2_ADCPmoor	245.B52-001	document	0	html	txt
B52_EcoFOCI_m2_Mooring	245.B52-002, 245.B52-005	document	0	html	txt
B52_EcoFOCI_m4_ADCPmoor	245.B52-003	document	0	html	txt
B52_EcoFOCI_m4_Mooring	245.B52-004	document	0	html	txt
B52_EcoFOCI_m5_08BSP5B	245.B52-006	document	0	html	txt
B52_EcoFOCI_m5_09BSP5A	245.B52-006	document	0	html	txt
B52_EcoFOCI_m5_08BS5B	245.B52-007	document	0	html	txt
B52_EcoFOCI_m5_09BS5A	245.B52-007	document	0	html	txt
B52_EcoFOCI_m5_08BSV5A	245.B52-008	document	0	html	txt
B52_EcoFOCI_m8_08BSP8A	245.B52-009	document	0	html	txt
B52_EcoFOCI_m8_08BS8A	245.B52-010	document	0	html	txt
B52_EcoFOCI_m8_08BSV8A	245.B52-011	document	0	html	txt
B52_EcoFOCI_m8_09BSV8A	245.B52-011	document	0	html	txt
BSIERP_ICHTHYO	253.B53-003	document	0	html	txt
SEACAT_BSIERP_ICHTHYO	245.B53-004	document	0	html	txt
B54_Heintz	245.B54-001	document	0	html	txt
B55_Stoecker_uZoop_Abundance	245.B55-001	document	0	html	txt
B55_Stoecker_uZoop_Grazing	245.B55-002	document	0	html	txt
B55_Stoecker_Abundance_2008-2010	245.B55-003	document	0	html	txt
B56_Moran_Radionuclides	245.B56-001	document	0	html	txt
B56_Moran_TrapFlux	245.B56-002	document	0	html	txt
B57_Grebmeier	245.B57-001	document	0	html	txt
B59_2008-2010_BASIS_BSIERP_v3	245.B59-003	document	0	html	txt
B60-Foreign_Reported_Catch_metadata	245.B60-001	document	0	html	txt
B60-Pollock_Eggs_metadata	245.B60-002	document	0	html	txt
B61_Aydin_2008-2010	245.B61-002	document	0	html	txt
B62_Cokelet_AL08_winter_summer	245.B62-001	document	0	html	txt
B62_Hollowed_euphausiid	245.B62-003	document	0	html	txt
B62_Hollowed_pollock	245.B62-004	document	0	html	txt
B62-Euphausiids_2010_metadata	245.B62-005	document	0	html	txt
B62-Midwater_pollock_2010_metadata	245.B62-006	document	0	html	txt
B62_Cokelet_AL09_winter_summer	245.B62-007	document	0	html	txt
B62_Cokelet_AL10_winter_summer	245.B62-008	document	0	html	txt
B62_Cokelet_Oscar_Dyson_2008	245.B62-009	document	0	html	txt
B62_Cokelet_Oscar_Dyson_2009	245.B62-010	document	0	html	txt
B62_Cokelet_Oscar_Dyson_2010	245.B62-011	document	0	html	txt
B62_Cokelet_Bottom_Trawl_Survey_CTD_2008	245.B62-012	document	0	html	txt
B62_Cokelet_Bottom_Trawl_Survey_CTD_2009	245.B62-013	document	0	html	txt
B62_Cokelet_Bottom_Trawl_Survey_CTD_2010	245.B62-014	document	0	html	txt
B62-Euphausiids_2009_metadata	245.B62-015	document	0	html	txt
B62-Midwater_pollock_2009_metadata	245.B62-016	document	0	html	txt
B63_Irons	245.B63-001	document	0	html	txt
B63_BLKI_forasgelocations2008-10	245.B63-002	document	0	html	txt
B63_TBMU_divelocations2008-10	245.B63-003	document	0	html	txt
B64_Kuletz	245.B64-001	document	0	html	txt

Figure 3. Table of errors from the checking and analysis of metadata through the *mp* metadata parser

BSIERP + BEST = The Bering Sea Project

The Bering Sea Project encompasses research activities from 2006 through 2015 that sought to understand the impacts of climate change and dynamic sea ice cover on the eastern Bering Sea ecosystem. The Bering Sea Project is unique in that it began as two separate but collaborative efforts sponsored by different agencies. The BEST Project was supported by NSF and BSIERP was organized and supported by the NPRB. During initial program planning BEST and BSIERP joined forces through a unified steering committee and a Science Advisory Board formed with representatives from each organization.

The BSIERP and BEST investigators collected data in the same region and time frame in an effort to improve understanding and prediction of complex ecosystem changes related to anthropogenic and natural causes. Unified BEST-BSIERP Principal Investigator meetings began in 2008. The two programs further merged during the analysis phase of the campaigns, sharing the single identity of the Bering Sea Project. Together, these complimentary programs provided an unprecedented amount of new data that will be important in understanding the ecosystem science and impacts of climate change in the Bering Sea region into the future.

Data Management Support

The EOL provided all facets of data management support to the Bering Sea Project. The major challenge for the data management team supporting the project was how to process and manage hundreds of multidisciplinary datasets coming from a variety of instrumentation and measurement platforms over multiple years and a variety of cruises.

During the initial years of data collection BEST and BSIERP each had it own disciplines and fields of interest, and the data management support for the programs developed independently. In the project planning stage separate program management plans were developed that included data collection, sharing and archival activities. Data managers were responsible for communicating with field researchers about what was required of data in terms of common standards, units and formats. The metadata requirements ensured accurate representation of the data, providing information needed for successful searching and the discovery of datasets, while ensuring compliance and interoperability with accepted metadata standards.

As data flowed into the archives, the sharing of metadata between the programs evolved into maintaining lists of datasets synchronized between two separate archive web sites and data repositories. The difficulties of keeping two archives synchronized with each other, providing access to datasets in separate archives, compounded as the programs matured. To address these concerns and further foster collaboration between these two long-term programs, the merging of the BEST and BSIERP archives began in December 2010. To facilitate the merging of the two databases, the Arctic Ocean Observing System (AOOS) maintained a reference copy on their servers of the BSIERP database that had been developed by the BSIERP data management team at the University of Alaska. This copy of the BSIERP database was ingested into the EOL relational database management system (EMDAC), combining the two databases into a single archive, and the diverse and complimentary data into a larger combined project database. Together, these complementary data archives formed the Bering Sea Project Archive.

Once the data were ingested into the EMDAC system, the datasets were made accessible to Axiom and BEST-BSIERP researchers. EOL started a conversation with Axiom on collaborating on unified approaches to display the data, but no real progress was made during the consolidated Bering Sea Project phase of the data management support. After the initial conversations, it appeared to us that Axiom had higher priorities in other activities and they never got back to us on any sort of collaboration**.** EOL did prepare for viewing on the Bering Sea Project Archive site Eastern Bering Sea Model visualizations by Alexander Kurapov and visualizations for a Climatological Oceanographic Atlas of the Bering Sea supplied by Gleb Panteleev.

Metadata Profiles

Managing the data and organizing the products of the research that came out of the project over the seven years of field work involved more than just the cataloging and storing of files. Making the data discoverable and easily accessible was the other part of the data management undertaking. To that end, metadata, as complete and accurate as possible, is required. The metadata stored in the EOL EMDAC relational database system identify and describe the data. These metadata comprise the complete catalog of project observations and enable the long-term search and discovery of Bering Sea Project data.

Realizing the pivotal role metadata has in the discovery and use of the datasets, agreement was reached in the planning stage that all BEST-BSIERP project metadata would comply with the Core Metadata for Geographic Datasets of the International Organization for Standardization (ISO) 19115 standard. Taking into consideration the biological emphasis of the BSIERP data, NPRB further stipulated that BSIERP PIs include taxonomies and additional metadata to also meet the FGDC Biological Data Profile of the Content Standard for Digital Geospatial Metadata. To aid in preparing these metadata, BSIERP PIs were provided with NPRB templates to be used with *Metavist*, a file based metadata creation tool developed by the United States Department of Agriculture (USDA) Forest Service – North Central Research Station.

The metadata profile defined at the early planning stages of the program ensured the collection of a consistent and rich cataloging of information for each dataset. The result is an accessible database that cross-references each unique investigator dataset. The data inventory of the Bering Sea Project can be perused through a search tool and listed in tables organized by cruise, subject category, or investigator's name. Program datasets can be listed separately, or together to get the complete coverage of the subject category.

Local and Traditional Knowledge

BSIERP investigators conducted interviews in the five communities of Akutan, St. Paul, Togiak, Emmonak, and Savoonga on local and traditional knowledge about the Bering Sea ecosystem, and conducted subsistence harvest surveys. The observations from local communities described a complex and changing ecosystem with high variability across the domain, and "underscored the importance of a long-term ethnographic approach to understanding recent changes in environmental conditions and local practices." (Huntington et al. 2013)

The Local and Traditional Knowledge (LTK) component of the BSIERP program data required special handling to ensure privacy of participants' identifiable information. Audio and visual records were never entered into the database, but were stored on a secure NCAR storage system under password control, with separate password access to the files. The summary notes, analysis of survey results, and assessment of harvests prepared by the PIs were archived and put online, but no sensitive material was made available through the data archive or the EMDAC system.

Metrics

The Bering Sea Project Archive contains multidisciplinary datasets within 31 categories of research. Both the BSIERP and BEST programs investigated the climate, oceanography, and lower trophic levels of the Bering Sea region. In addition, BSIERP investigators focused on the biology of the Bering Sea – forage species, fish, marine mammals and sea birds. During the active phase of the project, datasets were submitted to the archive and made accessible to the investigators as outlined in the project's data policy covering data collection, sharing, and archival activities. After a two-year period following data collection and post-collection processing (i.e. June 2013) all datasets were made publicly available through the online archive. The Bering Sea Project Archive presently contains 353 datasets with 779 gigabytes of data in 136,755 files. The total number of BSIERP datasets is 75, with 117.5 gigabytes of data in 510 files. (See Appendix A for list of BSIERP datasets). Since the archive came online at EOL, 1,126 orders for Bering Sea Project data have been fulfilled, of which 113 orders were specifically for BSIERP data. (See Appendix C for BSIERP data orders by year).

Long Term Stewardship

The EOL organized and continues to maintain the Bering Sea Project Archive (**http://beringsea.eol.ucar.edu**) as the source for all data from the combined efforts of the BEST and BSIERP programs. Datasets in the Bering Sea Project Archive are listed in the catalogs of repositories at other institutions through the sharing of metadata, with links to the EOL archive to access the data. The NSF Arctic Data Center, for one, managed by the National Center for Ecological Analysis and Synthesis

(NCEAS) and a successor to the Advanced Cooperative Arctic Data and Information Service (ACADIS), has a complete listing of all Bering Sea Project datasets. EOL remains the authoritative source for the data and metadata for these cross-listed datasets, and will continue to maintain project datasets and web pages, and update them as necessary if a revision is received. DOIs for these datasets are retained by EOL, with links going to the EOL datasets for the landing page description and ordering. In the broader picture regarding field project data that EOL has managed through the years and may continue to do so in the future, the NSF has decided that all datasets, web sites, and supporting products e.g. field catalogs, mapservers, etc., of "named" Arctic Field Programs will remain with EOL as the authoritative, primary source. This includes the BSIERP, BEST, and PacMARS projects, as well as 11 other Arctic field projects for which NCAR/EOL has managed the data and provided specialized support.

All BSIERP datasets have metadata conforming to the FGDC Biological Data Profile, as described with greater detail in a previous section of this report. In order to share the metadata of the Bering Sea Project with the greatest number of institutions, and prepare the metadata for utilization by a greater number of applications and services, EOL has also saved the metadata for each of the Bering Sea Project datasets in the ISO 19139 XML implementation schema for the ISO 19115-1 metadata standard.

EOL is investigating a semantic web search interface for field project data. *EOL Arctic Data Connects - Discovery and Access* (http://vivo.eol.ucar.edu) is a public proof of concept being developed by EarthCollab, an EarthCube Building Block sponsored by the National Science Foundation. The EarthCollab project is adapting and refining current ontologies for geospatial scientific datasets. EOL has selected the Bering Sea Project datasets for linking via the semantic web. All Bering Sea Project metadata have been transformed to the Resource Description Framework (RDF) for linked data, and connections to related resources are made through the *Arctic Data Connects* interface.

The data from the Bering Sea Project will be the final legacy of this research endeavor. The effort spent to unify the data and metadata from the BEST and BSIERP programs will allow improved search, perusal and access to these data well into the future. Providing the datasets from both projects via a single archive will also facilitate the important integration and synthesis activities critical to improved understanding of the Arctic ecosystem. EOL provides stewardship of the Bering Sea Project using the established capabilities of the EMDAC archive system.

All datasets in the archive have been assigned Digital Object Identifiers (DOIs). International agencies, professional societies, and research organizations are moving towards the formal citation of data and

sources that led to a given research result. Consequently, there has been an increased use of DOIs as a simple, standard way to reference datasets. DOIs allow for linkages between datasets and respective publications, thus providing the ability to track the use of these datasets in the literature and provide metrics of their use or influence. DOIs are considered "perpetual" and provide proper attribution, even if a dataset has been moved to another archive over time. Standards have been established for the creation of data DOIs and have been supported by international coordination groups such as the Research Data Alliance (RDA). Persistent citations for research datasets from the Bering Sea Project are handled through DataCite, a service that maintains all relevant DOI metadata. The DOIs for EOL Arctic Field Projects, including the BEST and BSIERP DOIs, are owned and remain with NCAR/EOL as the publisher and hosting institution. (See Appendix B for list of BSIERP datasets and DOIs).

Conclusion

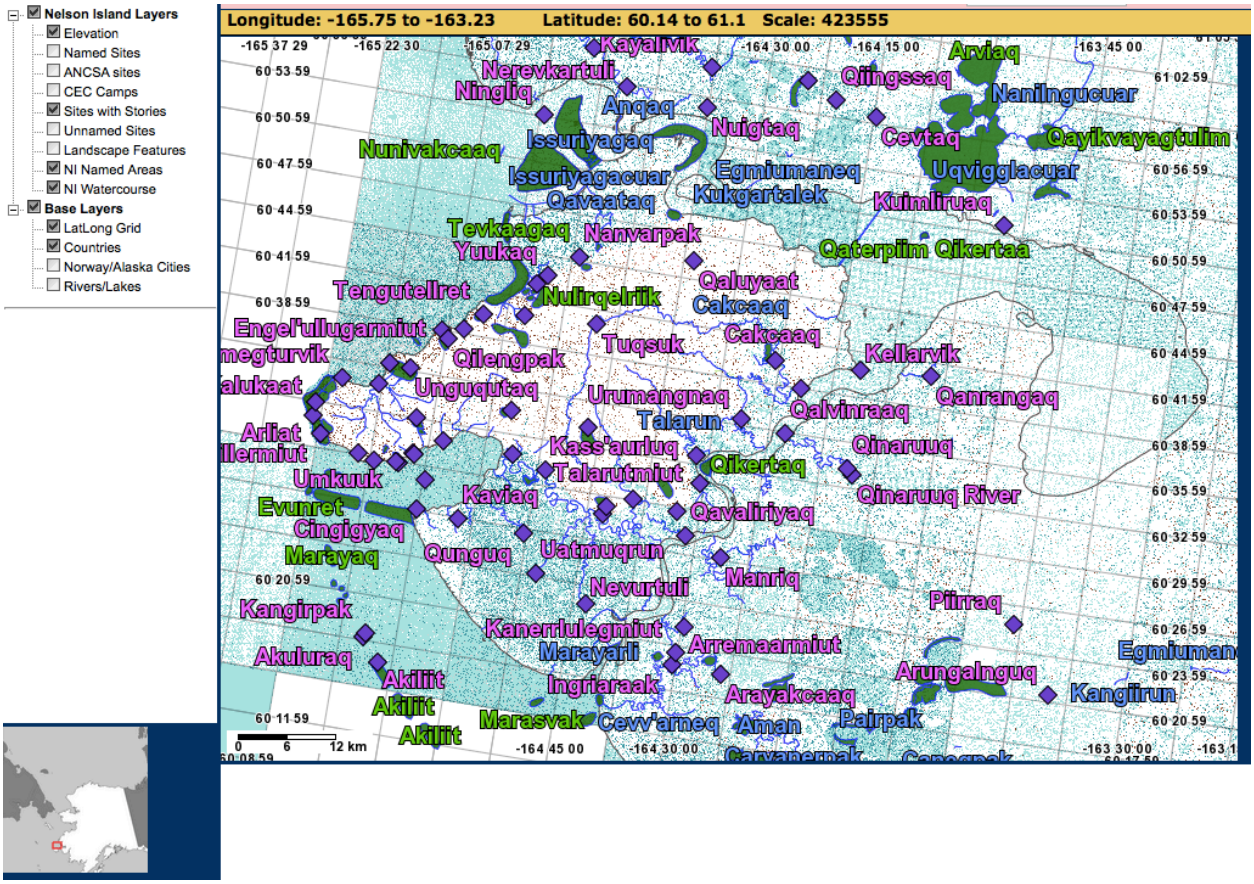
The BSIERP Program, as part of the Bering Sea Project, provided a unique and challenging opportunity for developing and implementing a comprehensive data management support strategy. We also include several important guidelines, or lessons learned for developing a successful data management strategy for future programs.

- Early involvement of data management professionals is necessary as investigator teams are developing the science observational strategies.
- Ensure participants understand the importance of data and metadata documentation before the start of observations to reduce the time spent later on to correct, update or "recreate" necessary metadata.
- Work closely with the funding agencies and science teams to specify time lines and due dates for the quality control and archiving of data.
- Provide the opportunity for training in the use of the tools critical to the data and metadata archival, e.g. *Metavist* and *mp*.
- It is much easier to agree to standardization across all observations ahead of the data collection phase than to try and "backfill" after the fact. Examples include:
    - Formats, e.g. ASCII, NetCDF, HDF
    - Metadata profile and content, e.g. following FGDC with Biological Extensions, ISO 19115 and 19139 WMO guidelines
    - Units (e.g. ppm, mole, cc) and Time (e.g. UTC)
- Provide data management support to the science teams and their support staff for preparing data and metadata for submission to the archive.
- Provision of web tools for the upload of data, metadata and documentation to the archive.

- Provision of and provide support for a long-term archive that offers continuity across multiple deployment years, and an effective web presence during and after the deployments and into the analysis phase.
- Ensure support for the long-term stewardship and preservation of the project data at the outset.
- Switching archives in the middle of a project should be avoided if at all possible. Considerable time was required to 'match' the metadata to the extent possible while continuing to receive and archive new datasets; retrieve all the data already sent to the defunct archive; and requesting resubmission of data, metadata and documentation as needed.
- A continuing challenge for data managers is how to handle the results of extensive modeling efforts. It is appropriate to archive the model code and accompanying forcing data but there must be careful consideration given to archiving multiple model output datasets.

BSIERP and Bering Sea Project Connections

A common theme developed throughout the Bering Sea Project was the goal that the research activities of one program would be reinforced and made richer through associated research by the partner program. The LTK data and metadata collection is a case in point of this objective. EOL worked closely with Local and Traditional Knowledge investigator Ann Fienup-Riordan, Alice Rearden, and the Calista Elders Council to develop a Geographic Information System (GIS) interactive tool for displaying detailed data and information collected during the BEST Nelson Island Project. (Figures 4 and 5) The web based tool mapped place names to traditional stories and photos of the locations. Eighty-three sites are represented for a total of five hundred forty pages of stories in Yup'ik, along with an English translation. The BSIERP program investigators conducted interviews with Alaska native elders in five indigenous communities along the Bering Sea coast on local and traditional knowledge. They also conducted subsistence harvest surveys. EOL facilitated communication between BSIERP and BEST Principal Investigators by preparing and making available the LTK data and metadata through the archive interface. Taken together, these BSIERP LTK datasets and the BEST GIS tool present a rich collection of local knowledge, harvest surveys, and traditional place names with stories from communities along the Eastern Bering Sea. The EOL effort on the LTK component, including support for GIS with place names and stories, data and metadata for BEST ethnography, and the cataloging of BSIERP LTK and survey data, aided the LTK and ethnography teams in collaborating on publications. These include three books published by Rearden, Fienup-Riordan and Frank Andrews, Sr. on the rich knowledge possessed by the Yup'ik. (Andrews 2008, Rearden and Fienup-Riordan 2011, Rearden and Fienup-Riordan 2012)



442

443 ***Figure 4.*** Screenshot of the Nelson Island Natural and Cultural Heritage Project Mapserver
444

Kellarvik, on the north shore of the Qalvinraaq River

Anna Agnus

Narrator: Anna Agnes

Anna: Uumek niiteqarrallrulrianga Kellarvigmek, kia taum qanrutkellrani, atra nalluyagutaqa. Tua-llam kangiiturtua wiinga, "Ca-gguq pitekluku tauna Kellarvigmek atengqerta?" Qanemcim-gguq ayagneq ilakaa. Ak'a-gguq tamaani yuut ukurmiut tua-i Up'nerkillermiungqellriit ua-i ak'a, cami-ll' tayim' ayagnillrua ugna Up'nerkillermiuq nunaurtellra.
<I first heard about Kellarvik when someone told a story about it, but I have forgotten the person's name. Then I asked, "Why is that place called Kellarvik?" He said the source [of the name] comes from a story. He said long ago, the people of this area, there is a place called Up'nerkillermiut that is down the coast, and I'm not sure when Up'nerkillermiut was founded.>

Tua-i tamatum ciungani ukut-gguq Qaluyaat inerquutangqelalriit makunun irniameggnun, panimeggnun, panimeggnun-wa tua-i inerquutangqelallruut naken aipangesqevkenaki. Paniteng ilulnguklallruit. Arcaqerluku-gguq una nunamiumek tua-i cucukliqaasqevkenaku tukuungraan.
<Before that time, they say the people of Nelson Island cautioned their children, their daughters, not to marry someone from another region. They were protective of their daughters. They especially told a person not to desire to marry someone from the inland region, even though he was wealthy.>

Una-gguq qaraliqniluku, waten tua-i uksurpak yuunginanermeggni neqnun kanarnatkameggni, qaraliqaat-gguq yuum amllerem kainiqurallni. Uksuq iquklipailgan ak'a-gguq kainiquratullruut tua-i tuaten. Kaigpalriartangqerraqluni-gguq allrakut iliitni.
<It is said that part of their way of life, as they were living, during winter before they had an availability of food, many people constantly experienced famine. Before winter ended, long ago, it is said they constantly experienced starvation. They said people experienced severe famine during some years.>

Tua-i-gguq-am ua-i ugna Kellarviuruyutekellrukii arnam taum, ukurritallrem nunamiunun. Caurrluni-ll' pia tayima temirnerurrluni-llu-w' pillilria; tua-i taukut ukurrisngaviin tua-i cakairucameng-am tua-i neqkaarairucameng tauna ukurrarteng pilliniat tua-i piyugngaurallrani kingunranun ayaagaasqumaniluku.
<It is said the source of the name Kellarvik originates from a woman [from Nelson Island] who had married someone from the inland region and moved there as a daughter-in-law. I'm not sure how old she was at the time, she had probably become an adult at the time; they say the people in the village

Figure 5. Screenshot of Yup'ik story when the Kellarvik place name is clicked on the Mapserver

Management or policy implications

High quality stewardship of large and diverse datasets generated over multiple years from different platforms by investigators from diverse institutions and backgrounds pose huge challenges and opportunities for the data managers of large collaborative research projects. The development of a comprehensive data management strategy is essential before and during the planning and implementation of the observations, and well into the analysis phases of the project. The development during this

454 planning stage of a clear specification for the metadata, or data about the data, and documentation to
455 accompany all datasets are important factors contributing to the creation of a data archive that is
456 searchable and interoperable. Finally, it is important for data managers to take on the responsibility of
457 communicating with field researchers about what is required of data in terms of common standards, units
458 and formats, and work with them in preparing and documenting their data for archival. The BSIERP and
459 BEST programs presented a coordinated effort from the beginning to address these planning concerns.
460 The planning, procedures and protocols could well be used as a case study for a successful methodology
461 on preparing and implementing data management for a large, diverse, multi-year and multi-agency field
462 project. After the collection phase when BSIERP experienced some challenges related to the long term
463 archival of the results, the commitment to the data policy was demonstrated by a quick response to get
464 back on track. These challenges occurring mid-project, and the successful steps taken to recover and
465 continue, illustrate the importance of a fully documented data policy accepted by all partners to guide the
466 continued data management effort.

467 **Poster presentations at scientific conferences or seminars**

468 Don Stott and James A. Moore
469 *BEST/BSIERP Data Management*
470 Alaska Marine Science Symposium. Anchorage, Alaska, January 2011
471
472 Don Stott, Amanda K. Orin, Steven F. Williams, and James A. Moore
473 *The Bering Sea Project Archive: Unifying the BEST and BSIERP Data Archives*
474 Alaska Marine Science Symposium. Anchorage, Alaska, January 2012
475
476 Don Stott, James A. Moore, Steven F. Williams, Janet Scannell, Amanda K. Orin and Michael Daniels
477 *The Legacy of the Bering Sea Project: Archival Preservation of Project Data for Current and Future*
478 *Research*
479 Alaska Marine Science Symposium. Anchorage, Alaska, January 2014
480 Bering Sea Open Science Meeting. Honolulu, Hawaii, February 2014
481 Federation of Earth Science Information Partners (ESIP) Winter Meeting. Washington, DC, January 2015
482
483 Don Stott, Matthew S. Mayernik, Michael D. Daniels, James A. Moore, Steven F. Williams, and John
484 Allison
485 *The Bering Sea Project Archive: a Prototype for Improved Discovery and Access*
486 American Geophysical Union, San Francisco, California, December 2015

488 **Literature Cited**

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491
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493 Scarbrough, L., Krieg, T., Lestenkof, P., Noongwook, G., Sheeran, K., and Zavadil, P.A. 2013.
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496 Rearden, A. and Fienup-Riordan, A. 2011. Qaluyaarmiuni Nunamtenek Qanemciput, Our Nelson
497 Island Stories. ISBN 978-0-295-99135. Calista Elders Council in assoc. with Univ. of
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499
500 Rearden, A. and Fienup-Riordan, A. 2012. Ellavut, Our Yu'pik World and Weather. ISBN 978-
501 0-295-99162. Univ. of Washington Press.

502 **Appendix A: BSIERP datasets by Project**

Project	Dataset Title	Author/PI
B52	Long-term observations on the Bering Sea shelf: Sediment mooring data from mooring site 8 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: Sediment mooring data from mooring site 5 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: biophysical mooring data from mooring site 8 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: biophysical mooring data from mooring site 5 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: ADCP data from mooring site 8 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: ADCP data from mooring site 5 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: ADCP data from mooring site 2 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: biophysical mooring data from site 4 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: biophysical mooring data from site 2 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B52	Long-term observations on the Bering Sea shelf: Sediment Trap Flux data from mooring site 2 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge

B52	Long-term observations on the Bering Sea shelf: ADCP data from mooring site 4 (B52)	Stabeno, Phyllis, Jeffrey Napp, and Terry Whitledge
B53	Seacat Data Profiles (B53)	Duffy-Anderson, Janet
B53	Ichthyoplankton Surveys, 2008-2010 (B53)	Duffy-Anderson, Janet
B54	Seasonal bioenergetics of pollock, Pacific cod, flounder and zooplankton in the Bering Sea (B54)	Heintz, Ron
B55	Summer Microzooplankton in the Bering Sea (B55)	Stoecker, Diane K. and Kristen L. Blattner
B55	Estimation of Micro-zooplankton (MZ) Abundance and Biomass, Summer 2010 (B55)	Stoecker, Diane K.
B55	Estimation of Micro-zooplankton (MZ) Abundance and Biomass, Summer 2008 (B55)	Stoecker, Diane K.
B56	Carbon export in the Eastern Bering Sea water column: TrapFlux (B56)	Moran, S. Bradley
B56	Carbon export in the Eastern Bering Sea water column: Radionuclides (B56)	Moran, S. Bradley
B57	Epibenthos Survey of the Bering Sea (B57)	Grebmeier, Jackie M., Lee W. Cooper, and Marisa L. Guarinello
B59	BASIS survey acoustics, 2008-2010 (B59)	Parker-Stetter, Sandra L. and John K. Horne
B60	Foreign Reported Pacific Cod and Walleye Pollock Fishery Catch Data 1963-1989 (B60)	Reese, Douglas C., Nathan Bacheler, and Lorenzo Ciannelli
B60	Pollock Egg Data (B60)	Ciannelli, Lorenzo, Nathan Bacheler, and Kevin Bailey
B61	Functional Foraging Response, 2008-2010 (B61)	Aydin, Kerim and Edward V. Farley
B62	Depth-integrated midwater pollock biomass in June, July, and August 2010 (B62)	Ressler, Patrick H.
B62	Depth-integrated midwater pollock biomass in June, July, and August 2009 (B62)	Ressler, Patrick H.
B62	Depth-integrated midwater pollock biomass in June and July 2008 (B62)	Ressler, Patrick H.
B62	Depth-integrated euphausiid (Family Euphausiidae) backscatter in June, July, and August 2010 (B62)	Ressler, Patrick H.
B62	Depth-integrated euphausiid (Family Euphausiidae) backscatter in June, July, and August 2009 (B62)	Ressler, Patrick H.
B62	Depth-integrated euphausiid (Family Euphausiidae) backscatter in June and July 2008 (B62)	Ressler, Patrick H.
B62	Underway Seawater Sampling Aboard NOAA ship Oscar Dyson in 2010, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Underway Seawater Sampling Aboard NOAA ship Oscar Dyson in 2009, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Underway Seawater Sampling Aboard NOAA ship Oscar Dyson in 2008, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Underway Seawater Sampling Aboard F/V Aldebaran in Winter & Summer 2010, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.

B62	Underway Seawater Sampling Aboard F/V Aldebaran in Winter & Summer 2009, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Underway Seawater Sampling Aboard F/V Aldebaran in Winter & Summer 2008, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Bottom Trawl Survey CTD data in 2010, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Bottom Trawl Survey CTD data in 2009, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B62	Bottom Trawl Survey CTD data in 2008, Forage Distribution and Ocean Conditions (B62)	Cokelet, Edward D.
B63	Foraging locations of black-legged kittiwakes at the Pribilof Islands 2008-10 (B63)	Paredes, Rosana, David B. Irons, and Daniel D. Roby
B63	Dive locations and parameters of Thick-billed murres at the Pribilof Islands, 2008-2010 (B63)	Paredes, Rosana, David B. Irons, and Daniel D. Roby
B63	Seabird Telemetry (B63)	Irons, David
B64	Seabird Broad-Scale Distribution 2008-2010 (B64)	Kuletz, Kathy
B65	Seabird Colony-based Studies 04.37, 2010 (B65)	Renner, Heather M.
B65	Seabird Colony-based Studies 04.37, 2009 (B65)	Byrd, Vernon
B65	Seabird Colony-based Studies 04.37, 2008 (B65)	Byrd, Vernon
B66	Whale broad-scale distribution southeastern Bering Sea 2008 (B66)	Friday, Nancy, Sue E. Moore, Phillip Clapham, and Alex Zerbini
B66	Whale broad-scale distribution southeastern Bering Sea 2010 (B66)	Friday, Nancy, Sue E. Moore, Phillip Clapham, Alex Zerbini, and Janice Waite
B67	Northern Fur Seal foraging, 2008, Patch Dynamics (B67)	Trites, Andrew W. and Brian Battaile
B67	Seabird Diving, Stress and Stable Isotopes, Pribilof and Bogoslof Islands, Patch Dynamics (B67 and B77)	Kitaysky, Alexander
B67	Seasonal Variability in Fatty Acid and Lipid Content in the Blubber of Pacific Walruses (B67)	Jay, Chadwick
B67	Pacific walrus foraging and haulout behavior collected in the central northern Bering Sea, Patch Dynamics Study (B67)	Jay, Chadwick
B67	CTD casts, Patch Dynamics (B67)	Benoit-Bird, Kelly
B67	Acoustic scattering from fish and euphausiids, Patch Dynamics (B67)	Benoit-Bird, Kelly
B68	Retrospective data on Fish, Birds, Mammals (B68)	Mueter, Franz and Gordon Kruse
B69	Bering Sea Project, Subsistence Harvest Monitoring Results for St. Paul Island, Alaska from 1999 to 2009. (B69)	Zavadil, Phillip A., Pamela Lestenkof, Dustin Jones, Paul Melovidov, Samantha Zacharof, and Haretina Porath
B69	Bering Sea Integrated Ecosystem Research Project, Local and Traditional Knowledge Component, St. Paul Island (B69)	Zavadil, Phillip A., Emily Melovidov, Pamela Lestenkof, and Samantha M. Zacharof
B69	Togiak Field Report for the Local and Traditional Knowledge component of the Bering Sea Integrated Ecosystem Research	Wisniewski, Josh and Theodore M. Krieg

	Program (B69)	
B69	2009 Comprehensive Subsistence Harvest Survey, Savoonga, Alaska (B69)	Tahbone, Sandra T. and Eric W. Trigg
B69	Akutan Field Report for the Local and Traditional Knowledge component of the Bering Sea Integrated Ecosystem Research Program (B69)	Sepez, Jennifer and Eugene S. Hunn
B69	2008 Comprehensive Subsistence Harvest Survey, Emmonak, Togiak, and Akutan, Alaska (B69)	Fall, James A.
B69	Emmonak Field Report for the Local and Traditional Knowledge component of the Bering Sea Integrated Ecosystem Research Program (B69)	Brown, Caroline, Nicole M. Braem, Robbin Lavine, Seth Wilson, and Michael Jimmy
B70	FEAST Hindcast Model Output 1970-2009 (B70)	Ortiz, Ivonne, Kerim Aydin, and Al Hermann
B70	FEAST Hindcast Model 1970-2009 (B70)	Ortiz, Ivonne, Kerim Aydin, Al Hermann, Georgina Gibson, and Enrique Curchitser
B71	Downscaled catch data for Bering Sea groundfish and herring fisheries, 1970-2009 (B71)	Dalton, Michael
B72	Spatial Economic Models of Pollock and Cod 1991-2013 (B72)	Haynie, Alan
B73	Management Strategy Evaluation: Hindcast Model Output, 1979-2012 (B73)	Punt, Andre, Kirstin Holsman, Jim Ianelli, and Liz Moffitt
B74	Development and analysis of life-history models to predict the evolution of reaction norms in early development of seabirds and their consequences on individual and population dynamics in the face of climate change (B74)	Vincenzi, Simone and William H. Satterthwaite
B75	Correlative Biomass Dynamics Model (B75)	Uchiyama, Tadayasu, Gordon Kruse, and Franz Mueter
B77	Stomach contents of birds collected at sea (B77)	Jones, Nathan, Kathy Turco
B77	Stable isotope analysis for birds collected at sea (B77)	Jones, Nathan, Kathy Kuletz
B92	Top Predator Hotspot Persistence	Sigler, Mike, Kathy Kuletz, Chris Wilson, Nancy Friday, and Patrick Ressler
B99	Regional Boundary Data for the Bering Sea	Ortiz, Ivonne, Francis Wiese and Angie Greig

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504 **Appendix B: List of BSIERP Datasets and DOIs**

Dataset ID	DOI	Contact
245.B52-001	doi:10.5065/D64Q7RZQ	Phyllis J. Stabeno
245.B52-002	doi:10.5065/D6JQ0Z15	Phyllis J. Stabeno
245.B52-003	doi:10.5065/D6PN93MD	Phyllis J. Stabeno
245.B52-004	doi:10.5065/D66H4FFP	Phyllis J. Stabeno
245.B52-005	doi:10.5065/D6R78C6F	Phyllis J. Stabeno
245.B52-006	doi:10.5065/D6SF2T6X	Phyllis J. Stabeno
245.B52-007	doi:10.5065/D6V122SX	Phyllis J. Stabeno

245.B52-008	doi:10.5065/D61Z42C5	Phyllis J. Stabeno
245.B52-009	doi:10.5065/D67942PH	Phyllis J. Stabeno
245.B52-010	doi:10.5065/D6PG1PQ1	Phyllis J. Stabeno
245.B52-011	doi:10.5065/D6W66HSV	Phyllis J. Stabeno
245.B53-003	doi:10.5065/D6T72FFR	Janet Duffy-Anderson
245.B53-004	doi:10.5065/D6B27S8G	Janet Duffy-Anderson
245.B54-001	doi:10.5065/D69C6VC2	Ron Heintz
245.B55-001	doi:10.5065/D62R3PPH	Diane K. Stoecker
245.B55-002	doi:10.5065/D6JW8BV7	Diane K. Stoecker
245.B55-003	doi:10.5065/D6V69GKK	Diane K. Stoecker
245.B56-001	doi:10.5065/D63R0QVB	S. Bradley Moran
245.B56-002	doi:10.5065/D6FX77FN	S. Bradley Moran
245.B57-001	doi:10.5065/D6F18WQH	Jacqueline M. Grebmeier
245.B59-003	doi:10.5065/D63J39ZS	Sandra Parker-Stetter
245.B60-001	doi:10.5065/D6SJ1HNP	Lorenzo Ciannelli
245.B60-002	doi:10.5065/D6NS0RXZ	Lorenzo Ciannelli
245.B61-002	doi:10.5065/D6NP22F4	Kerim Aydin
245.B62-001	doi:10.5065/D67H1GJM	Edward D. Cokelet
245.B62-003	doi:10.5065/D6C24TF9	Patrick H. Ressler
245.B62-004	doi:10.5065/D6988511	Patrick H. Ressler
245.B62-005	doi:10.5065/D6HT2M93	Patrick H. Ressler
245.B62-006	doi:10.5065/D6MP5189	Patrick H. Ressler
245.B62-007	doi:10.5065/D6FT8J1B	Edward D. Cokelet
245.B62-008	doi:10.5065/D65M63P5	Edward D. Cokelet
245.B62-009	doi:10.5065/D68C9T84	Edward D. Cokelet
245.B62-010	doi:10.5065/D6ZS2TGH	Edward D. Cokelet
245.B62-011	doi:10.5065/D6QC01GX	Edward D. Cokelet
245.B62-012	doi:10.5065/D6NG4NM3	Edward D. Cokelet
245.B62-013	doi:10.5065/D6GT5K65	Edward D. Cokelet
245.B62-014	doi:10.5065/D6F47M3S	Edward D. Cokelet
245.B62-015	doi:10.5065/D68913VB	Patrick H. Ressler
245.B62-016	doi:10.5065/D6D50JZJ	Patrick H. Ressler
245.B63-001	doi:10.5065/D6W093W9	David B. Irons
245.B63-002	doi:10.5065/D6B8564Z	Rosana Paredes
245.B63-003	doi:10.5065/D6C53HVM	Rosana Paredes
245.B64-001	doi:10.5065/D62J68VV	EOL Data Support
245.B64-002	doi:10.5065/D6KP804X	EOL Data Support
245.B64-003	doi:10.5065/D6CF9N5B	Kathy J. Kuletz
245.B65-001	doi:10.5065/D6GX48JK	Vernon Byrd
245.B65-002	doi:10.5065/D6X06513	Heather M. Renner
245.B65-003	doi:10.5065/D61R6NHP	Heather M. Renner

245.B66-001	doi:10.5065/D6MK69W1	Nancy Friday
245.B66-002	doi:10.5065/D6KK98S3	Nancy Friday
245.B67-001	doi:10.5065/D6QF8QVV	Kelly Benoit-Bird
245.B67-002	doi:10.5065/D65H7D8V	Kelly Benoit-Bird
245.B67-003	doi:10.5065/D64J0C3K	Chadwick V. Jay
245.B67-004	doi:10.5065/D6000038	Chadwick V. Jay
245.B67-005	doi:10.5065/D6S75D9C	Alexander (Sasha) Kitaysky
245.B67-006	doi:10.5065/D60Z7187	Andrew Trites
245.B68-001	doi:10.5065/D66971J4	Franz Mueter
245.B69-001	doi:10.5065/D60R9MC9	Jennifer Sepez
245.B69-002	doi:10.5065/D6125QMK	Caroline Brown
245.B69-003	doi:10.5065/D6D21VM4	David S. Koster
245.B69-004	doi:10.5065/D6Z0365G	Eric W. Trigg
245.B69-005	doi:10.5065/D6HX19PZ	Phillip A. Zavadil
245.B69-006	doi:10.5065/D6RF5S13	Phillip A. Zavadil
245.B69-007	doi:10.5065/D6X63JX7	Henry P. Huntington
245.B70-001	doi:10.5065/D6J1016B	Ivonne Ortiz
245.B70-002	doi:10.5065/D6D798FM	Ivonne Ortiz
245.B71-001	doi:10.5065/D64Q7S2G	Michael Dalton
245.B72-001	doi:10.5065/D68G8HRB	Alan C. Haynie
245.B73-001	doi:10.5065/D6WD3XMH	Andre Punt
245.B74-001	doi:10.5065/D6125QPG	Simone Vincenzi
245.B75-001	doi:10.5065/D6W95771	Tadayasu Uchiyama
245.B77-001	doi:10.5065/D6RJ4GH9	Nathan M. Jones
245.B77-002	doi:10.5065/D6MS3QSK	Nathan M. Jones
245.B92-001	doi:10.5065/D6H1301H	Mike Sigler
245.B99-001	doi:10.5065/D6DF6P6C	Ivonne Ortiz

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Appendix C: BSIERP Data Orders by Year

Metrics

BSIERP: Bering Sea Integrated Ecosystem Research Program Metrics	
Unique Users: 53	Total Orders: 113 Unique Orders: 94
Total Data Served: 920.3 MB